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Sommario/riassunto	This expanded version to the 2010 edition features quantum annealing algorithm and its application for optimization problems. Recent progress on quantum computing, especially, advanced topics such as Shor's algorithm, quantum search, quantum cryptography and architecture of quantum bit are also included.Book is self-contained and unified in its description of the cross-disciplinary nature of this field. It is not strictly mathematical, but aims to provide intuitive and transparent ideas of the subjects. The book starts from basic quantum mechanics and EPR pair and its measurements. Fundamental concepts of classical computer are given in order to extend it to quantum computer. Classical information theory is also explained in detail such as Shannon and Von Neumann entropy. Then quantum algorithm is introduced starting from Dutch-Josza and ending up with Shor's factorization algorithms. Quantum cryptography is also introduced such as BB84 Protocol, B92 protocol and E91 protocol. Eventually quantum search algorithm is explained.In summary, the book starts from basic quantum mechanics and eventually comes up to state-of-the art quantum algorithm of quantum computations and computers. Students can obtain practical problem-solving ability by attempting the exercises at the end of each chapter. Detailed solutions to all problems are provided.